

Welcome to



# Agenda

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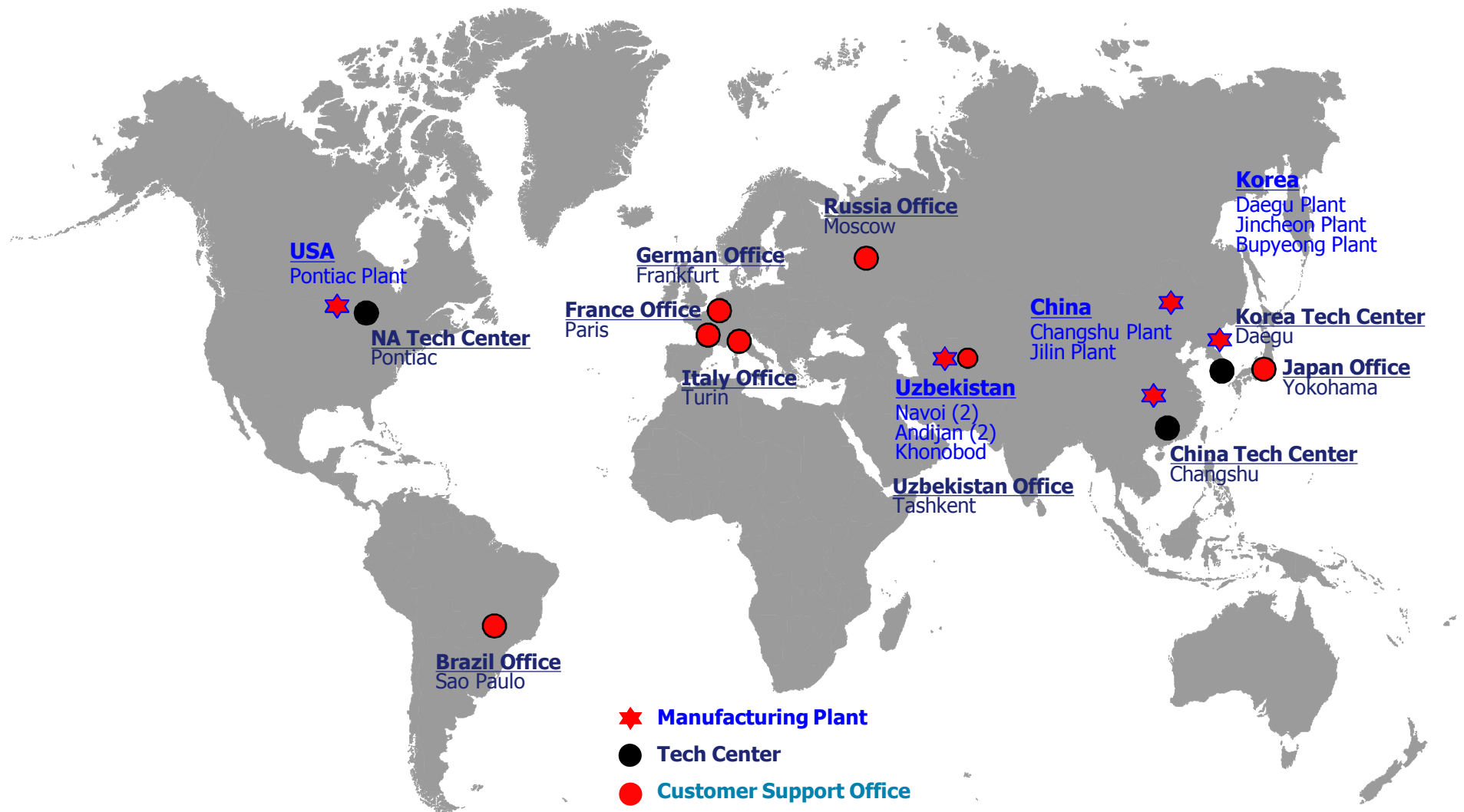
## Company Overview

# Milestones

	<u>Footprints</u>	<u>Customers</u>
2018 ~	<ul style="list-style-type: none"> <li>● ERAE USA (Pontiac Plant)</li> </ul>	<ul style="list-style-type: none"> <li>● Porsche</li> <li>● Maserati, Alfa Romeo</li> <li>● Rivian, Canoo</li> <li>● Volkswagen</li> </ul>
Oct 1, 2017	<ul style="list-style-type: none"> <li>● ERAE AMS was newly established through corporate split</li> </ul>	
2011 ~ 2017	<ul style="list-style-type: none"> <li>● German Office</li> <li>● Brazil ERAE</li> <li>● Japan Office</li> <li>● E-Intelligence</li> <li>● Italy Office</li> <li>● Jilin ERAE</li> <li>● Shanghai Office</li> </ul>	<ul style="list-style-type: none"> <li>● Polaris</li> <li>● GM Global (Direct)</li> <li>● Chrysler (NA)</li> <li>● Audi (Europe)</li> <li>● Volkswagen (China)</li> </ul>
2001 ~ 2010	<ul style="list-style-type: none"> <li>● ERAE USA (Branch)</li> <li>● Changshu ERAE</li> </ul>	<ul style="list-style-type: none"> <li>● Suzuki (Japan)</li> <li>● Daihatsu (Japan)</li> <li>● GM Uzbekistan</li> <li>● Hyundai MOBIS (HKMC)</li> <li>● Shanghai GM</li> </ul>
1984 ~ 2000	<ul style="list-style-type: none"> <li>● New Tech Center</li> <li>● 5 Factories in Korea</li> <li>● Company Established</li> </ul>	<ul style="list-style-type: none"> <li>● GM Korea</li> <li>● GM Global (K/D)</li> <li>● Korean OEMs</li> </ul>

# Global Footprint

**11 Manufacturing Sites in 4 Countries**  
**3 Technical Centers and 7 Customer Support Offices**



# Customer Awards



**FCA  
APAC Awards Supplier  
of the Year  
(2017/16/14)**



**FCA  
Outstanding Quality  
Performance  
(2017)**



**GM  
Supplier of the Year  
(2015/14/13/12/06)**



**GM  
Supplier Quality  
Excellence Award  
(2013)**

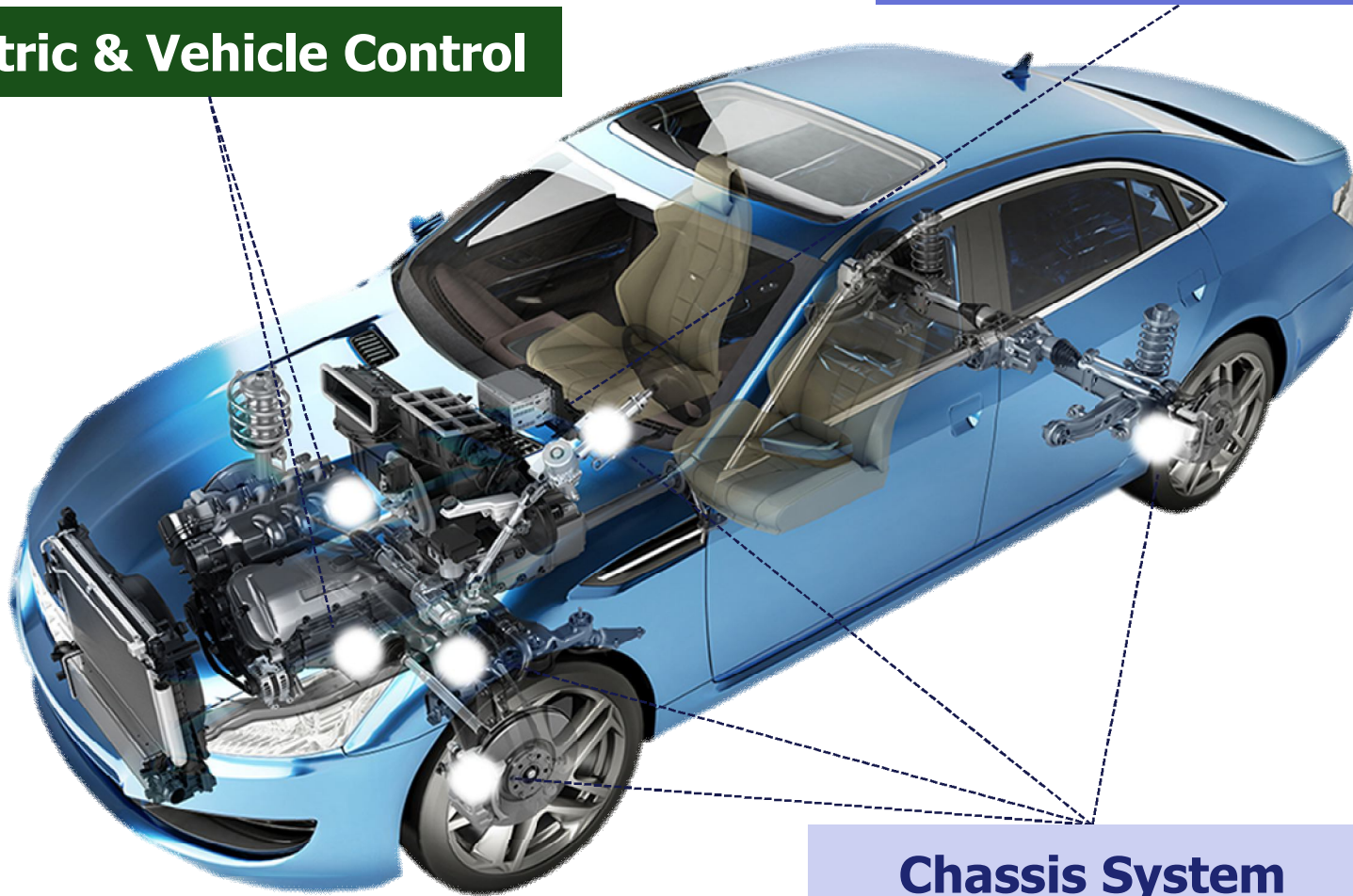


**TOYOTA  
Quality Performance  
Achievement Award  
(2014/10/08/07/06/05)**

# Product Portfolio

**Electric & Vehicle Control**

**ADAS & Infotainment**



**Chassis System**



# Product Introduction



Rzeppa Joint  
(High Efficiency)



Halfshaft



Tripod Joint  
(Anti-Shudder)



Propeller Shaft Joint



Double Offset Joint



Cross Groove Joint



Monobloc Tubular Shaft



Ball Spline Shaft

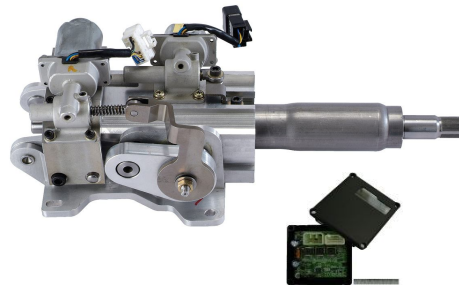


Intermediate Drive Shaft

# Product Introduction



Steering Columns



Power Tilt & Tele. Column



Column Drive EPS



Intermediate Shaft



Steering Gears



# Product Introduction



Calipers



6-Pistons Fixed Caliper



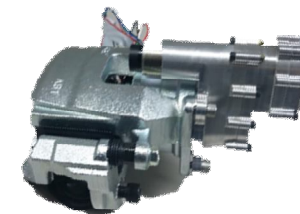
Integral Parking Brakes



Motor-on-Calipers



Cable Puller



Electric Mechanical Brakes



ABS / ESC



Aluminum Boosters



Electric Vacuum Pump



Vacuum Switch/Sensor

# Product Introduction



3 Phase  
Alternator



6 Phase  
Alternator



6 Phase  
(Flat wire)  
Alternator



MOSFET  
Alternator



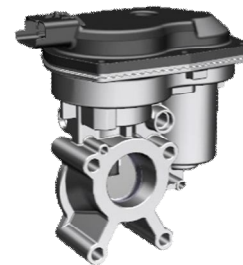
48V BAS



Rotary  
EGR Valve



Geared  
EGR Valve

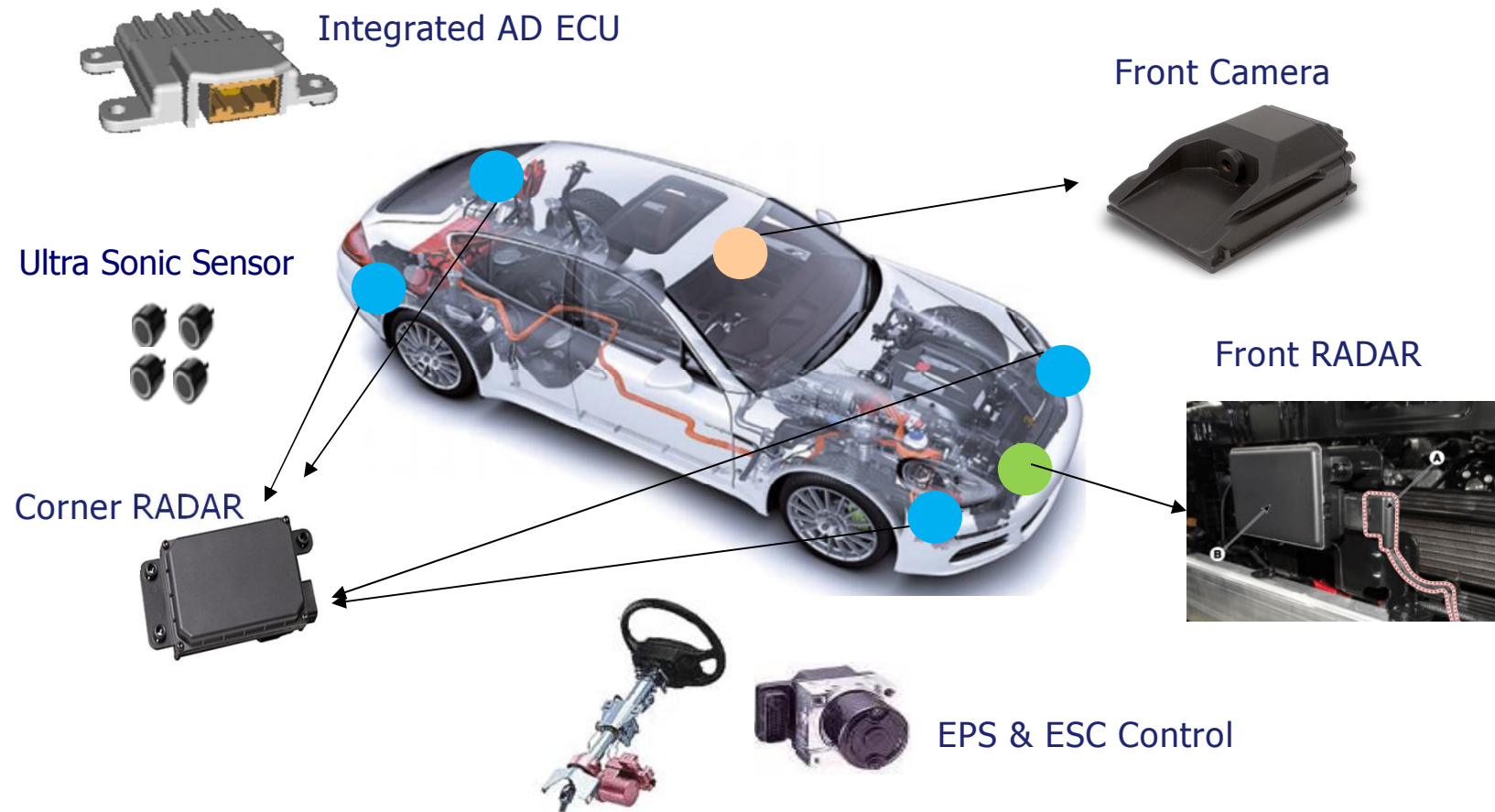


Butterfly  
EGR Valve



Vehicle Control Unit  
(For EV)

# Product Introduction



## ADAS Functions

- LDW: Lane Departure Warning
- FCW: Forward Collision Warning
- AEB : Autonomous Emergency Braking
- LKAS :Lane Keeping Assist System
- PAS : Parking Assist System
- LCS : Lane Centering System
- ASCC : Advanced Smart Cruise Control
- HWA: Highway Assist

# Product Introduction



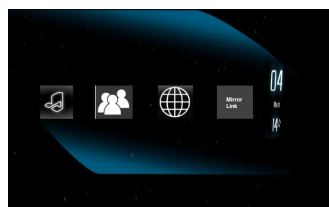
Instrument Cluster



Central Display



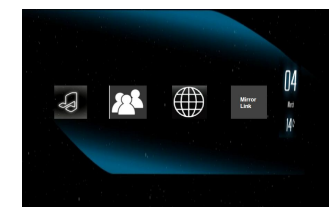
Passenger Display



RSE



Display Switch



RSE



Smart AV (7")



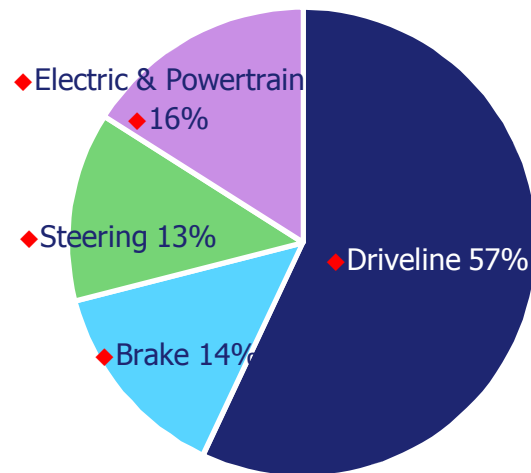
Entry Infotainment (8")



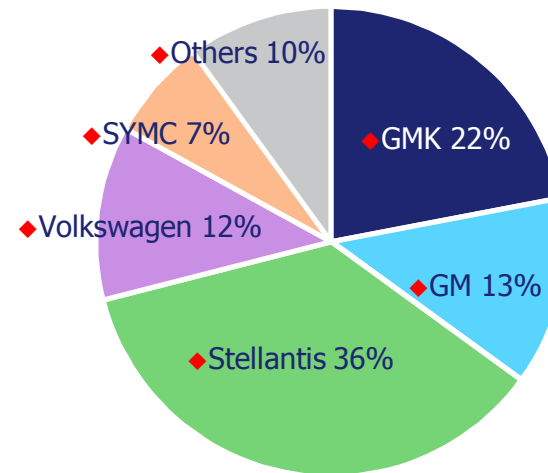
Medium Infotainment (10.1")

# Business Overview & Customers

◆ By Product



◆ By Customer



# Agenda

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**2**

**Engineering Capability**



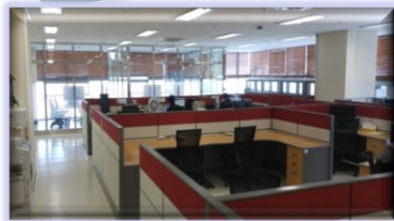
# Korea Technical Center



- **FATEC**  
(Future Automotive Tech Center)

- **Smart Car System**
  - Autonomous Driving
  - Connected Car
  - V2V, V2X
- **Green Car System**
  - VCU, 48V BAS, Inverter, Converter

- **Interior Eng. Center**
  - Infotainment



- **HQ Tech Center**

- Advanced Research & Development
  - Chassis : Driveline, Steering, Brake
  - Electric : Alternator, EGR
- Test Laboratories, Computer Analysis & Design
- Global Program Management



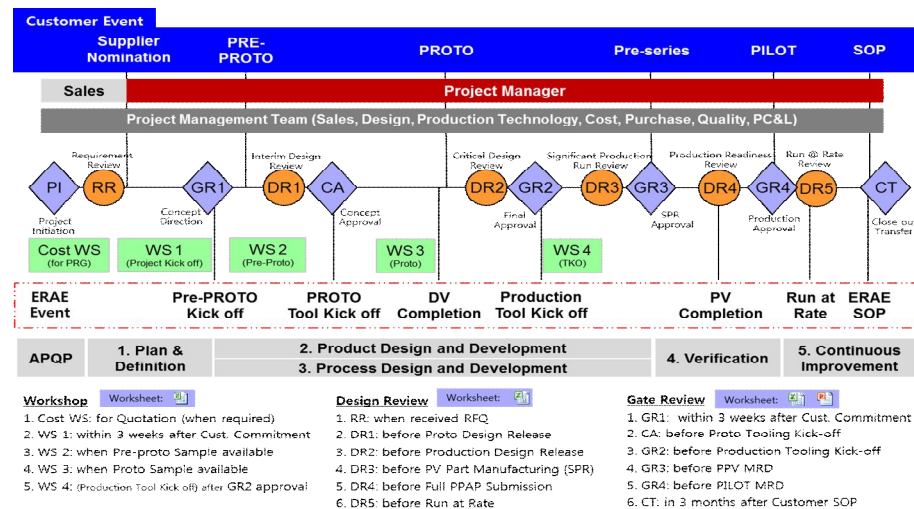
- **e-Intelligence**

- ADAS
- Autonomous Driving



# Global Program Management

- ◆ ERAE Product Development Process specifies global project management process, roles & responsibility of organization to fulfill APQP & customer requirements
- ◆ Managed in Project Management System (PMS)



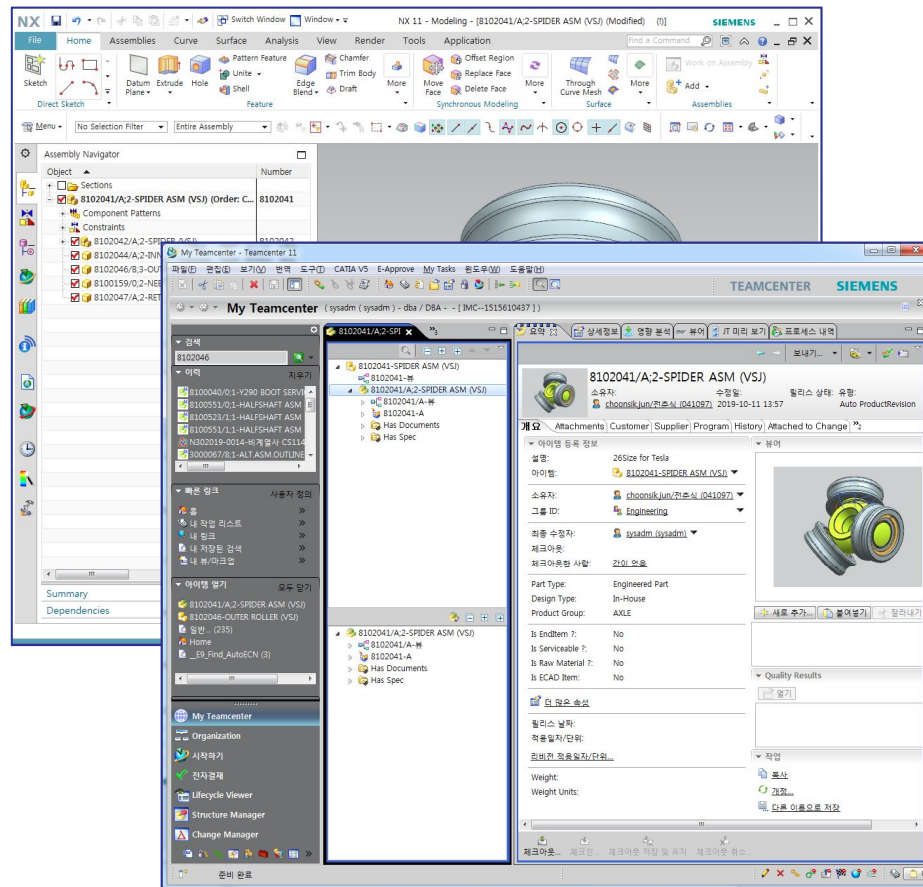
Product Development Process Framework



Project Management System

# Change Management

- ◆ Apply the **Teamcenter** engineering change process to efficiently respond to global standards & OEMs
- ◆ Changes on project are ensured by project organization through **PDM System**



NX and Teamcenter

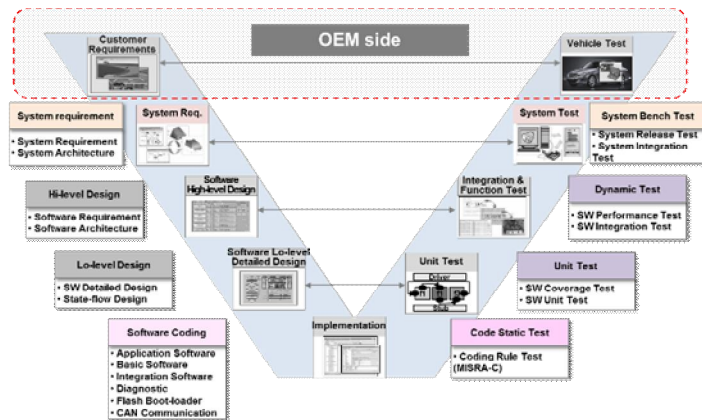
Engineering Change Request			
		Approval	
		과장	부장
		권재식	이거식
		상신	승준근
		2019/09/09	2019/09/09
Doc. No.	PCS2019-0014	Phone	053-610-2398
Team	전장생기팀	Submission Date	2019-09-09
Review Team	전장생산부, 전장품관팀, 외주개발팀, 원가기획팀, 품질전략-SOE전장팀, 전장생산부		
Recipient	김경민, 김무림, 박정우, 이상관, 조성섭, 최홍용		
Title	비계열사 CS114D Rotor Type 변경 건 (NP Type 확대 적용)		
Product	ALTERNATOR	Project No.	EBS01
Type of Change	Class : Self-Engineering Chs	Type :	Productivity Improver
Model No.	CS-114D (LS엔트론, 등양롤산/메이텍메스엔트론)		
Part No.	223130 / 220273	Part Name.	Rotor ASM
Reason for Change Request	- CS114D NP Rotor Connection 적용 비계열사 확대 적용 - 공정 공용화 / 간소화 및 불량 개선		

Engineering Change Notice			
		Approval	
		과장	부장
		이승훈	이원우
		승인	승인
		2019-09-27	2019-09-27
Consultor	Time	Comment	
서태수 과장 / 시험시작팀	2019-09-27 09:54	1. 동일 설계 항목에 대한 검토 기관별 2. 추가모달 확대 적용으로 PV 불필요	
Doc. ID	N302019-0014	Security Lvl.	비밀
Author	손철일	Department	전장생기팀
Date	2019-09-25	Phone No.	053-610-1612
RCV. DEPT.	외주개발팀, 전장생기팀, 전장생산부, 전장품관팀, 품질전략-SOE전장팀		
Reference	권재식, 김경민, 김무림, 박정우, 조성섭, 최홍용		
Title	비계열사 CS114D Rotor NP Type Connection 추가 설명		
REF. URL	[OMS-AU] 설계변경 적용 보고 (EC application report)		
Product	ALTERNATOR		
Type of Change	Class : Self-Engineering Change	Type :	Cost improvement
Usage	Manufacturing release	Project No.	N/A

ECR and ECN in PDM

# Software Development Process

- ◆ Process Model for SW Dev. - Based on **V-Model**, **CMMI** Level 3, **ISO26262** Level 1 has achieved (2017/2019)
- ◆ Software Management Tools - “**ATLASSIAN** : JIRA, Confluence, BitBucket, Bamboo etc.”



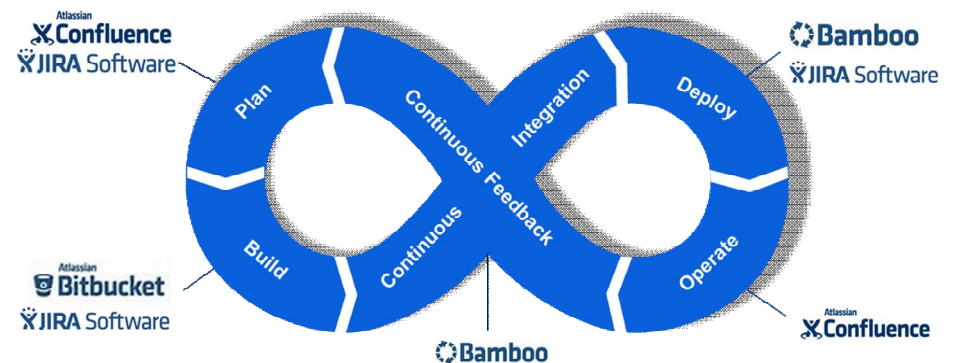
Traditional V-Model



CMMI / ISO26262 Certification



Agile Process



SW Management Tool : ATLASSIAN



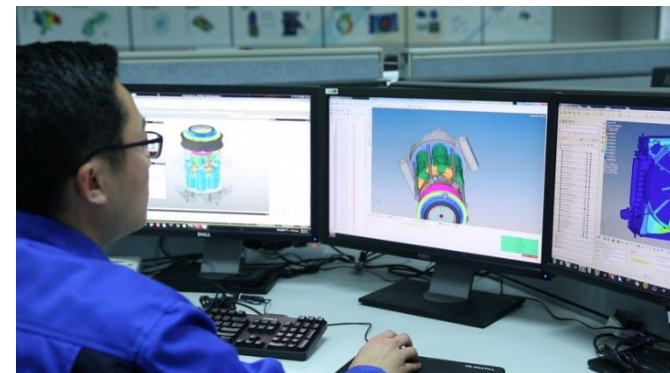
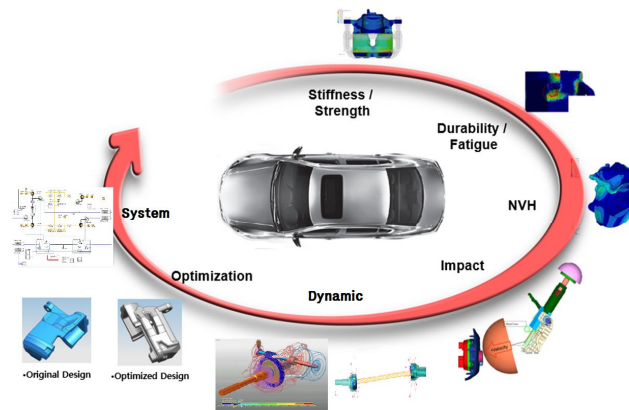
# CAD & CAE Capabilities

## ◆ CAD

- NX, CATIA, Pro-E, AutoCAD

## ◆ CAE Capabilities

- Structure, Vibration, Thermal Stress Analysis : *ABAQUS, ANSYS*
- Fatigue Analysis : *FE-Fatigue*
- Dynamic Analysis : *RecurDyn*
- Crash & Forming Analysis : *LS-DYNA*
- Optimization : *Hyperworks(OptiStruct)*
- Hydro-pneumatic System Simulation : *Simulation X*



# Material Analysis Capabilities

## ◆ Capabilities

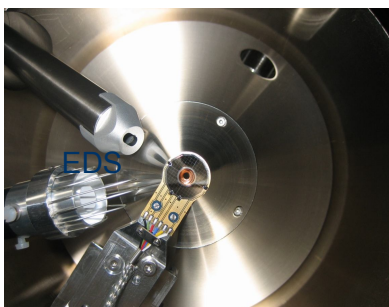
- Material Analysis of Steel/Aluminum, Plastic/Rubber/Lubricant/Chemicals and Hazardous Substance
- Failure Analysis : Fracture/Deformation/Leak/Contamination
- Performance Test for Metal, Organic Materials, and Surface treatment/Coating properties.

## ◆ Element Composition and Image Analysis

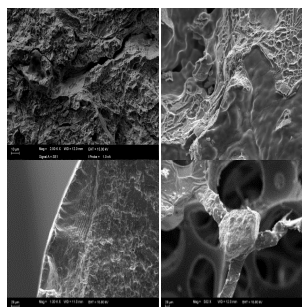
# SEM



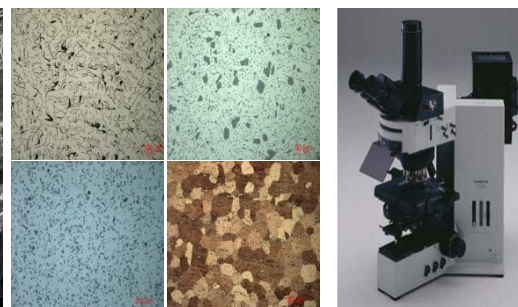
EDS



## Micro Fractography



## Metallographic examination

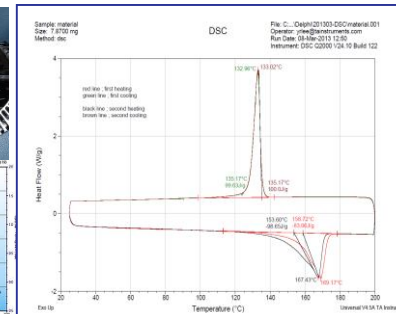
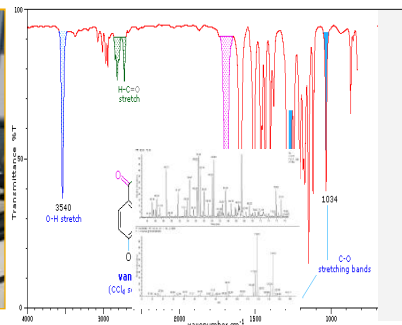


## ◆ Chemical Structure and Thermal Properties

## FT-IR Analysis



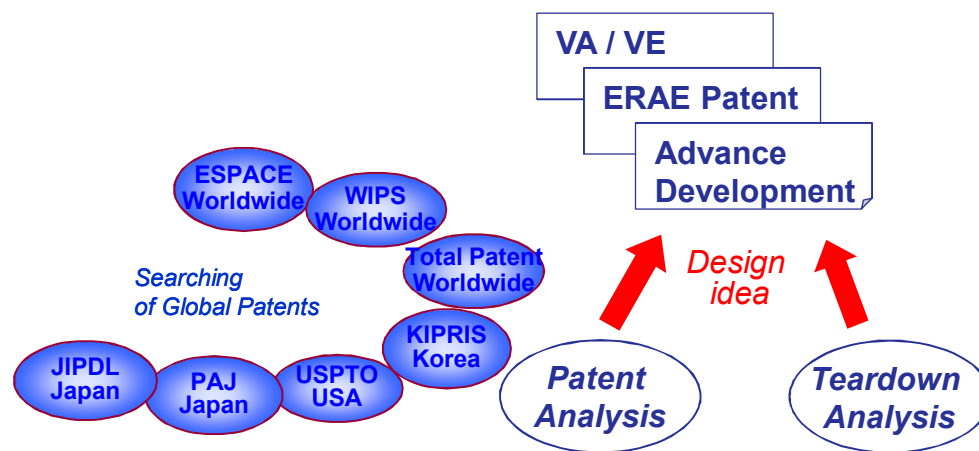
## Thermal analysis(DSC & TGA)



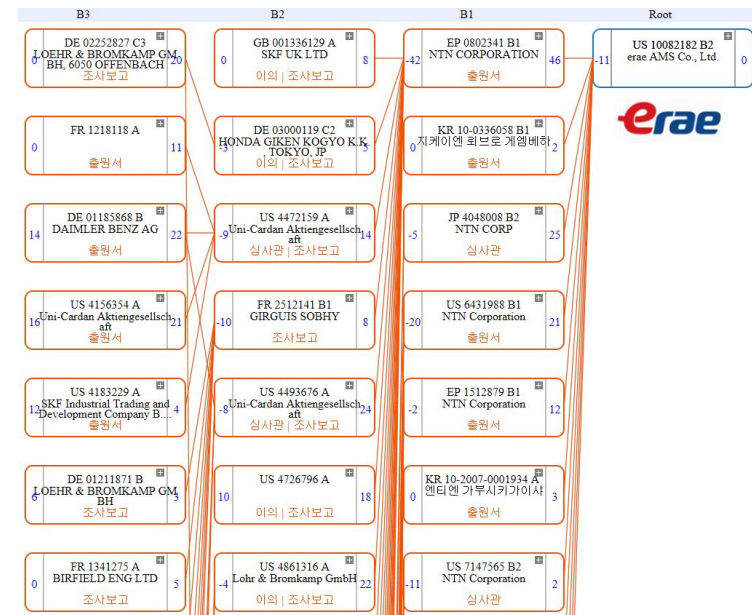


# Competitor Analysis Capabilities

- ◆ Teardown Analysis
  - to catch out the competitor's technology **opened to the market**
- ◆ Patent Analysis / Mapping
  - to find out the competitor's technology **not-opened to the market**
- ◆ 2 Dedicated experts for patents and tear-down analysis



Design Idea thru Patent/Teardown



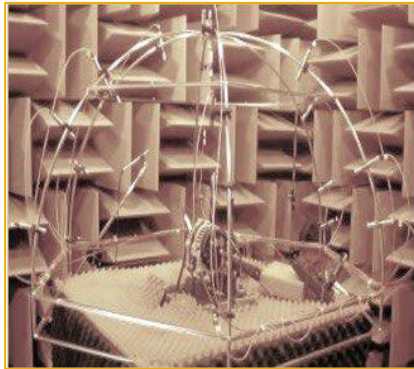
Patent Mapping

# Test Facilities

## ◆ NVH Laboratory

- Electro-magnetic shakers for vibration test, Anechoic chambers for components and vehicle noise tests and Various analysis tools

Anechoic Chamber



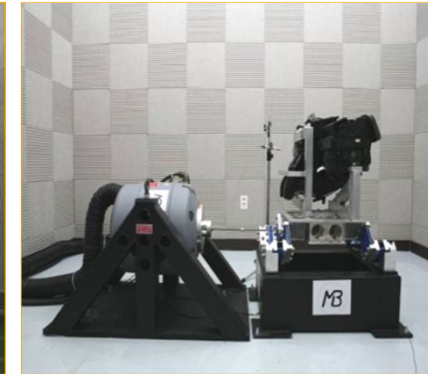
Electric Shaker



Vehicle Noise Test Room

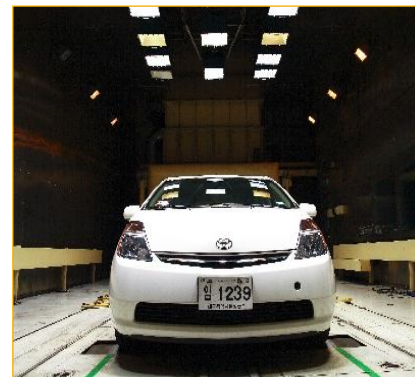
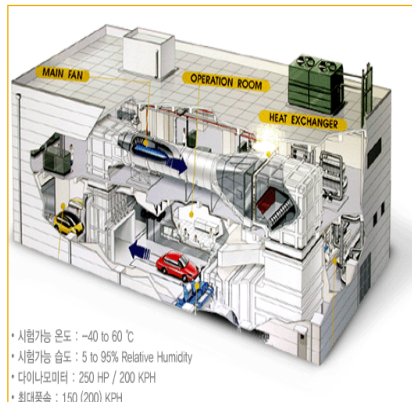


Squeak & Rattle Noise



## ◆ Wind Tunnel

- Wind tunnel test for Powertrain in vehicle condition





# Test Facilities

## ◆ Steering System Laboratory

EPS Performance



I-Shaft



Gear Wear



EPS Durability



## ◆ Halfshaft Laboratory

- Performance check, Road simulation durability using RLDA analysis and Wear performance evaluation for Halfshaft

Axial Force



Efficiency



Real time Wear



General Wear



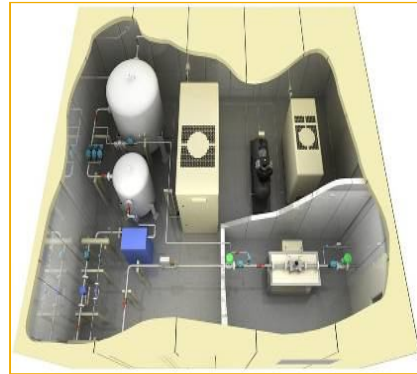
# Test Facilities

## ◆ Electric Laboratory

Alternator Performance



EGR Flow Stand



Alternator Durability



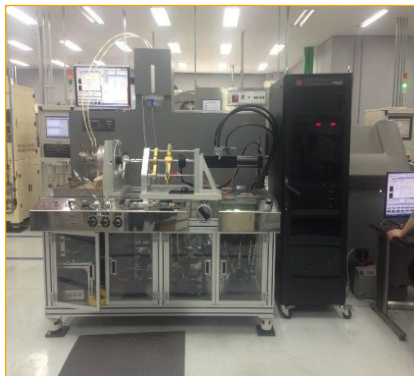
Engine Dynamometer



## ◆ Brake System Laboratory

- Performance, durability tests and measuring friction, noise and vibration at brake dynamometer for Brake system

Power Brake Performance



Caliper Brake Performance



Brake Noise Dyno



Brake Inertia Dyno





# Proto Shop Facilities

## ◆ Facilities for proto sample build & measure

### ▪ Prototype Facilities

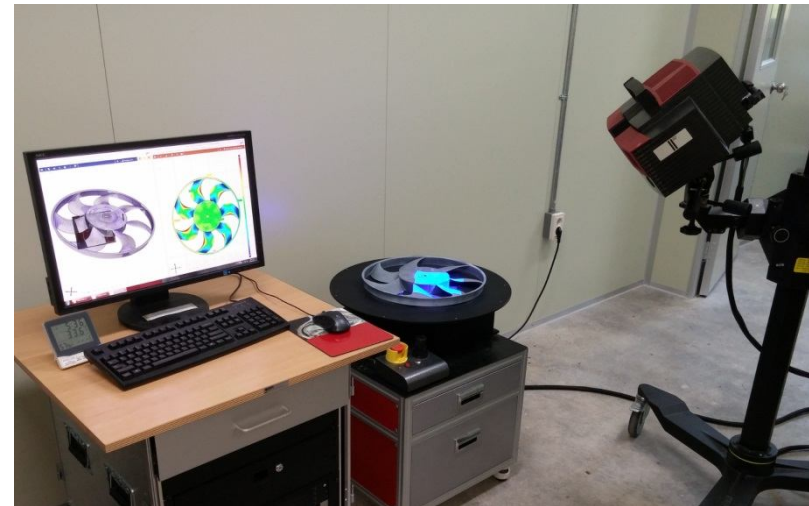
- 1 3D-Printer
- 4 Machining Equipment
  - MTC, CNC, Milling, Lathe
- 2 UTM (2/10Ton)
- 2 Hydraulic Press (5/50Ton)
- 6 Welding machines



3D Printer

### ▪ Measuring Facilities

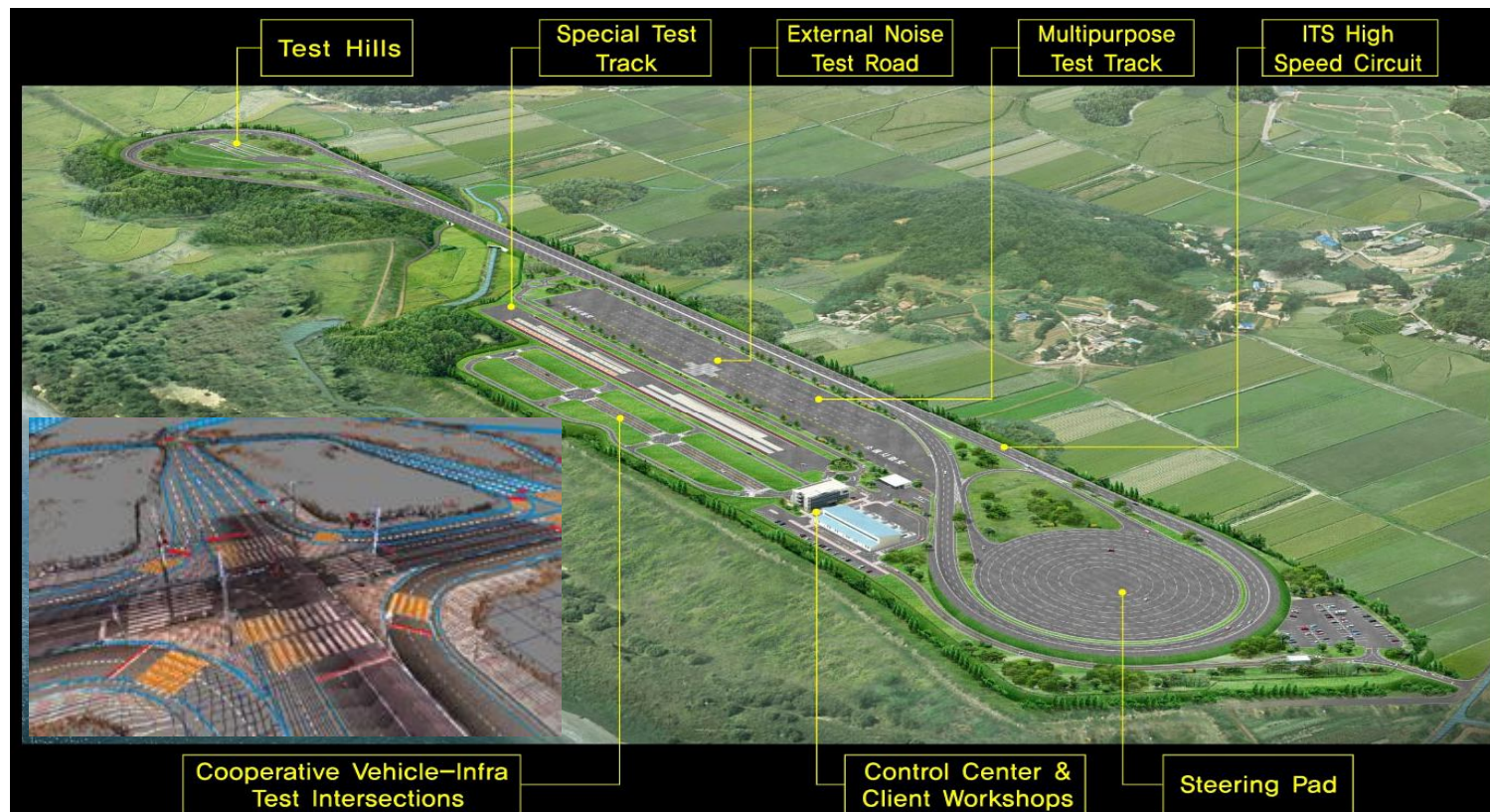
- CMM (Accura, Zeiss)
- 3D Scanner
- Profile Projector
- Roughness and Contour measurement system (MarSurf XCR 20)



3D Scanner

# ITS Proving Ground

- ◆ It can perform braking and steering performance tests as well as **autonomous driving** and **ADAS related tests** such as **LKAS**, **CTS**, **Connected Car** and **V2X**
  - Location : 20 minutes from ERAE
  - Area : 385,000 m<sup>2</sup>
  - Investment : ERAE Co-ownership





# China Technical Center

- ◆ Location: Develop Zone, Changshu City, Jiangsu Province

- ✓ Land area: 20,018 m<sup>2</sup>
- ✓ Office area: 9,384 m<sup>2</sup>
- ✓ Laboratory: 200 m<sup>2</sup>

- ◆ Laboratory Capability:

- ✓ Interm Shaft Performance tester
- ✓ Anechoic Noise tester
- ✓ Alternator Durability tester
- ✓ Brake Performance/Durability Tester

- ◆ Provide Local Testing Support for:

- ✓ New Business Pursuit
- ✓ Program Development
- ✓ Current Model Warranty/Quality Issues



I-Shaft Function tester



Anochoic Noise tester



Alternator Durability tester

# NA Technical Center

- ◆ Location: Pontiac Michigan USA
  - ✓ Laboratory Area : 510 m<sup>2</sup>
- ◆ Laboratory Capability:
  - ✓ Halfshaft torsional fatigue tester
  - ✓ Halfshaft boot durability tester
  - ✓ Universal test machine
  - ✓ Halfshaft high angle tester (Progressing)
  - ✓ Halfshaft wear tester (Progressing)
- ◆ Provide Local Testing Support for:
  - ✓ Program Development
  - ✓ Current Model Warranty/Quality Issues



Torsional fatigue tester



Boot durability tester



High angle tester